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ABSTRACT

To meet the need for educational audiologists in Hawaii schools, a cooperative program was designed to establish an educational audiology component in the existing speech-language pathology program at the University of Hawaii. Planned by the University of Hawaii, the Hawaii Department of Education, and the State Education Agency, the Hawaii-based program was needed because of the acute shortage of educational audiologists coupled with the difficulty of recruiting on the mainland. The primary goal of the program was to establish services to the hearing impaired not served by existing programs in Hawaii schools. The target population included children with auditory perceptual disturbances, those with hearing sensitivity and/or acuity disorders, and children with transient disturbances such as otitis media. Phase I of the three-phase program is based at the University of Hawaii and covers preprofessional or basic information coursework, clinical training, and practicum experience. Phase II is the development of a model service center that provides diagnostic and evaluative services and is the referral and management center of the hearing involved children. Phase III is services to the schools, including an information network, referral center for children with suspected hearing disorders, inservice, counseling, and prescriptive diagnosis. (JHZ)

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DEVELOPING AUDIOLOGY IN THE PUBLIC SCHOOLS SERVICES DELIVERY DEVELOPMENT FOR RURAL POPULATIONS

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DEVELOPING AUDIOLOGY IN THE PUBLIC SCHOOLS
SERVICES DELIVERY DEVELOPMENT FOR RURAL POPULATIONS

This paper describes a program which is establishing Educational Audiology in Hawaii through an innovative approach. While the teaching program and service implementation strategy involve hearing it is sufficiently adaptable to serve as a model for developing and implementing services of virtually any type in a rural environment. Reasonable access to a training program and commitment of cooperation between the training program and host State Education Agency (SEA) is required.

A. The Problem

Hearing disorders in children and adults can be divided into at least two categories. The first is composed of those classes of disturbances which result in the classically described shifts in hearing sensitivity and/or a diminished acuity. The second is a group loosely defined as disorders of central auditory processing. The negative impact of the former, at least in their more severe forms, has long been recognized. The impact of central processing disturbances is less well recognized and understood. Both have vast potential to disturb the educational process and both are addressed by our project.

1. Prevalence

Losses of sensitivity and acuity affect millions of Americans of all ages. At least 14 to 16 million by some estimates (Schow, Nerbonne, 1980). Another two million are deaf. Hearing loss, particularly when it is selective in nature, is the most insidious of all handicapping conditions. Therefore, it is highly probable that the estimates of hearing impaired is conservative due to the many that go unrecognized, unidentified and unreported.

The problem of determining occurrence is apparent in the pre-school and school age group. It would be easy to believe that a captive, institutionalized population with a federally mandated service delivery system would be able to provide excellent data relative to prevalence, types, and effect of hearing loss. Such is not the case. First, services are by no means uniformly or even widely distributed. Second, standards are changing due to an emerging understanding of the effects of hearing disorders of "mild" nature, and of those affecting the central processing system. Third, it is rare when the school has an effective, comprehensive identification system with the coordinated information retrieval and storage system necessary to develop good data. Most of what we know is from estimates and extrapolations of data, a point that in itself supports the need for services.

The best estimates are those of Audiology Services In The Schools (1981) that use known incidence from careful samples to project 30 to 50 hearing impaired children per 1,000 student population. Based on the 1980 school census of 47 million

(Conference of Education, 1980) there would be from 1.41 million to 2,350,000 hearing impaired in the nation's schools. These projections are supported by studies which consistently find range of occurrence in the 30 to 50 per 1,000 area.

In Hawaii, the Department of Health identification program results for the 1980-84 period fell within the 3 to 5 percent range. Immittance screenings for "medically significant" hearing loss only resulted in a 3 to 4.5 percent failure rate for the years 1980 through 1984.

While the figures appear to confirm our incidence to be well within the national norms, there are extenuating circumstances. First, the program is confined mostly to urban Oahu, the island on which Honolulu is located. Oahu has a large (about 78 percent) percentage of the state's population but is basically urban in character. Rural populations have greater incidence of external and middle ear disorders. Second, the program tended to be represented in the urban schools more than even rural Oahu. Third, each school was seen only once, a fact that is not conducive to identifying those who have temporarily remissed to the point that they can pass a screening. Fourth, the screening is only among K, 1st, 2nd, 3rd and 7th grade students. Finally, and most importantly, Hawaii's program is designed to look only for those who have medically significant hearing disorder. Even in the face of all the aforementioned limitations, 3,446 children were found to have medically significant conditions and referred for treatment in 1984 alone. In summary, 3,446 children were identified. To those must be added children who 1) passed the screening but had losses not identifiable by tympanometry, 2) were not tested at all, 3) who would pass but later develop significant otologic disorder, and 4) children identified in previous years and not included in these statistics. Summaries of the hearing screenings for the 1982-84 period are in Tables I and II.

Insert Tables I
and II about here

Identification programs typically focus on medically significant hearing disorders and that stress is defensible for a number of reasons. In addition to the obvious threat to health passed on from middle ear disease, there is the accompanying hearing loss and overall debilitation or decrease in "state of wellness" that accompanies any chronic or long duration physical ailment. Whatever the reason, current evidence clearly indicates that otitis media has deleterious effect on linguistic and academic attainment (Fisch, 1983; Shriber and Smith, 1983; Sak and Ruben, 1982; and McDermott, 1983). Studies have found that otitis media in early years interferes with normal maturation of central auditory processing (Welsh et al, 1983) and another suggests that permanent low level change in hearing sensitivity results in reduced development of the auditory neural network and delays in speech-language and cognitive skills dependent upon hearing

TABLE 1
HEARING STATISTICS FOR OAHU 1982-83

	Total Screened	#Ref.	%Ref.	#Complete	%Complete	#Deficit	%Deficit
Preschools	4669	129	3	58	45	54	93
Priv./Parochial	7113	86	1	47	55	42	89
DOE Elem.	29910	882	3	443	50	405	91
DOE Inter.	9352	261	1	65	25	57	88
DOE High	8576	118	1.3	27	23	27	100
TOTAL	59,620	1,476	2.5	640	43	585	91

TABLE II
HEARING STATISTICS FOR OAHU 1983-84

	Total Screened	#Ref.	%Ref.	#Complete	%Complete	#Deficit	%Deficit
Preschools	5421	410	8	269	66	227	84
Priv./Parochial	9601	314	3	211	67	165	78
DOE Elem.	38540	2135	6	1178	55	946	80
DOE Inter.	9390	168	2	62	37	53	85
DOE High	7645	116	1.5	28	24	24	86
TOTAL	70,597	3,143	4.5	1,748	56	1,415	81%

(McDermott, 1983). A recently reported study links inattention and poor language skills to early ear infections. North Carolina researchers monitored 44 day care children from 3 months to 7 years. Thirteen of the children had numerous ear infections, nine or more episodes in the first three years. Those nine children were found to have significantly poorer narrative skills at ages 5 and 7 than the other children. They also had twice as many periods of classroom inattention as the 31 other children (Feagans, 1986). Otitis media alone has sufficient potential to interfere with the educational process to warrant educational audiologists to provide diagnosis, evaluation, management, remedial, and consultative services.

There is a population of "hard of hearing" children with bilateral nerve loss ranging from 26 to 90 dB HL that exceeds 300,000 nationally. These children have communication, emotional, social, educational and prevocational deficits ranging from mild impairment to incapacitation (Blair and Berg, 1982). Another group, with special hearing needs is the special education population which typically has extraordinarily high percentages of hearing impairments and/or central processing disturbances. The special education population has an 18 percent or greater rate of occurrence of otitis media alone (Murdock et al, 1983; Dermody et al, 1983; Sak and Rubin, 1982). Hawaii's identified special education population is in excess of 12,000. As late as 1982, the percentage of enrollment in special education in Hawaii, then 5.69 percent of the K through 12 census was one of the lowest in the nation. In fact, only Alabama (5.44 percent) had a smaller percentage of its students in special education programs (Education of the Handicapped, 1982).

Over 1,800 of Hawaii's special education population is classified as Specific Learning Disabled (SLD). SLD children have extraordinarily high failure rates in hearing tests, and tests of central auditory processing (Dermody et al, 1983; ASHA, 1983). Failure rates of 50 percent or over of CAP screening by SLD children is not uncommon. In summary, there are literally millions of children nationally and thousands in Hawaii who have hearing disorders sufficient to require and benefit from restorative services. A large percentage of the children with severe to profound losses are receiving special services. However, a majority of those with mild or moderate losses are not receiving services (Maestas Y. Moores and Moores, 1977). The Bureau of Education of the Handicapped (BEH) study (Sontag, Smith, and Certo, 1977) estimated that 90 percent of the identified deaf were served but only 20 percent of the then identified hard of hearing were receiving services.

In the years since the BEH study, an entirely new problem has emerged, the child with mild, low frequency or broad spectrum hearing loss and systemic disturbances due to middle ear disorders. There has been little additional service capability but the populations to be served has grown.

2. Personnel Need

National standards have been established for determining staffing for programs for the hearing impaired. The guidelines for Hearing Impaired Children (1976) recommended one audiologist for each 75 hearing impaired children receiving special instruction in the educational setting. A more recent study (Berg, 1984) suggests that a 1 to 40 ratio is an appropriate target and more than a 1 to 50 ratio is excessive. Based on Hawaii's identified population of hearing impaired, and the role defined for the educational audiologist, the Hawaii Department of Education (DOE) projected a need for 1983-84 of 23 specialists in hearing impaired to begin services provision. Due to the critical shortage of speech-language clinicians and the total lack of educational audiologists none were hired. The Hawaii State Plan projected a need for twelve hearing personnel for 1985-88. There have been positions since 1978 and Hawaii is yet to employ its first educational audiologist in the public schools.

Nationally, personnel to fill positions in the schools simply are not available. There are only about 570 claimants to the title "educational audiologists" (Wilson-Vlotman, 1984; Berg, 1984) and an undetermined number of these are self-annointed. Very few training programs are preparing educational audiologists and the demand is far in excess of supply. It has been estimated that as many as 9,400 educational audiologists may be needed to implement even the most conservative proposal (Iowa Model) for meeting national needs for services and mandated by Public Law 94-142. Training programs already are taxed in trying to meet the Speech Pathology job market in times of shrinking university budgets. If the educational audiology job market is to be addressed, outside funding will be necessary.

3. Hawaii Program

For Hawaii, recruiting educational audiologists out of state was, and is, out of the question. We already were recruiting on the mainland for DOE speech-language specialists with little success and the pool of audiologists available is smaller yet. The answer was to establish an educational audiology component in the existing program in Speech-Language Pathology at the University of Hawaii. Although we have operated for over 40 years and offered Masters' degrees in audiology and speech pathology since 1956, we, like most American universities, had little educational audiology in our curriculum.

We designed a program in cooperation with the Hawaii Department of Education (DOE), the State Education Agency (SEA). The primary goal of the program was to establish services to the hearing impaired in Hawaii's schools not served by existing progams for the severely impaired. The target population included children with auditory perceptual disturbances, those with hearing sensitivity and/or acuity disorders otherwise not served and children with transient disturbances such as otitis media.

A three phase program was designed to meet program needs. In Phase I, a training program was developed at the University of Hawaii with clinical training in Hawaii's public schools. In Phase II, a separate but integrated program, we developed a model service center (MSC). The center provides diagnostic, evaluative, prescriptive, habilitative counselling and resource services for hearing handicapped children and their families and educators. Phase III is the establishment of a model service delivery program in the public schools.

Phase I - The Training Program. It is inevitable that the education base of any professional program will be associated with an accredited college or university program. However, it is not necessary that all training be conducted in formal classrooms on campus. We had as a program guideline the concept that much of the training as possible would take place in the schools to be served under direction of appropriate personnel with formal appointment on the university faculty. The program also attempted to recruit individuals for the initial student population with training and/or experience that would facilitate rapid completion of the training program. We will continue to recruit in this manner because of positive results in quality of graduate cost, effectiveness and significantly reduced training time.

The competency based training program is divided into 1) the preprofessional or basic information stage, 2) the clinical training stage, and 3) practicum and clinical experience which comprise professional training (see Table III). The program is based on course units and structured in such a way that those courses which do not require fixed classroom or laboratory base can be offered off-campus by our faculty, visiting professors, qualified contract instructors, telecommunication or some combination of the above. On site instruction aids in retraining other professionals in audiology while they continue their present positions thus allowing combination clinical placement/advanced instruction, and reducing costs both for the student and the participating district.

Insert Table III
about here

Core curriculum, including basic sciences, anatomy and physiology, requires such extensive materials and instrumentation that it is almost impossible to complete other than in an appropriately equipped training program. Certain courses that are less dependent upon instrumentation and hands-on involvement can be offered off-site or through tele-media. Most of the preprofessional training sequence, therefore, is provided on the campus. The only logical alternative is recruitment of students who already have completed preprofessional (undergraduate) training or who have a background that minimizes the necessary preparations. After audiology majors, undergraduate speech-language pathology majors are best prepared for professional training in audiology.

TABLE III. PROGRAM CONTENT IN AUDIOLOGY

CONTENT AREA	APPROXIMATE % OF PROGRAM
I. Basic Science	15%
A. Acoustics and Psychoacoustics	
B. Calibration, Noise, and Instrumentation	
C. Anatomy and Physiology	
D. Statistics	
E. Acoustic Phonetics	
II. Development and Pathology of the Auditory System	10%
A. Embryology	
B. Auditory Development in Children (reaction of sound as a function of age)	
C. Effects of Aging on the Auditory System	
D. Auditory Pathology (hearing disorders)	
III. Evaluation	33%
A. Use of Case History Information	
B. Behavioral Test Procedures	
C. Educational Audiological Evaluation	
D. Physiologic Test Procedures	
E. Interpretation of Test Results	
F. Identification Procedures	

CONTENT AREA	APPROXIMATE % OF PROGRAM
IV. Habilitation and Rehabilitation	30%
A. Surgical and/or Medical Treatment	
B. Hearing Aids	
C. Effects of Hearing Impaired on Speech and Language	
D. Educational, Vocational and Psycho-Social Implications	
E. Program/Modeling for Young Hearing Impaired Child	
F. Evaluation, Educational and Remediation Procedures	
G. Management of the Hearing Impaired Child	
V. Speech and Language	12%
A. Normal Development	
B. Sociolinguistic Differences	
C. Language Disorders	
D. Teaching Language to the Hearing Impaired	
E. Teaching Speech to the Hearing Impaired	
F. Reading for the Hearing Impaired	

Psychology, Pre-Medicine, Nursing, or other health care preparations and certain areas of special education and education are helpful to the study of audiology.

Professional training begins at the graduate level. Our students complete 44 semester hours and receive the Master of Science degree. Table IV is the graduate curriculum outline.

Insert Table IV
about here

Clinical training must include significant experience in at least two sites and initial clinical experience must be at the training institution (requirement of accrediting body). Within that requirement, as much of the clinical experience as possible is conducted in the schools (which qualify as one of the sites). The advantage to the school district is that the university program and the schools work together to design the service delivery model for the school system. It is developed by the training program while audiologists are trained and then turned over to the schools as an in-place, functioning program with staff, administration, procedures appropriate to the need.

4. Expected Roles or Positions

We will provide training for 15 educational audiologists in the first three years of this program. To date, two students have completed training and a total of eight will finish training during the period. The additional seven will be in various stages of the program at the end of the first cycle in 1988. Over the projected life of the program, we will train 24 to 26 plus 8-10 replacements for a total of 32 to 36 audiologists. The program then will scale down to a target of approximately 4-6 per year to meet growth and attrition needs.

Basically, we are creating a professional whose role is 1) to provide direct services to the hearing disordered population, 2) to serve as case manager for the target population, 3) to advocate in appropriate forum, and 4) to provide resource for and support to service deliveries in the consultative teaching model.

Tasks

1. In the role of service providers, the educational audiologists provide:

   Identification of the hearing impaired and children with auditory perceptual disorders

   Evaluation including educational auditory function, language performance level, (re)habilitation requirement, hearing aid evaluation as appropriate

TABLE IV. Professional (Graduate) Core Curriculum in Audiology. List is not exhaustive. Students have one option course in major.

COURSE NUMBER	COURSE TITLE
SPA 600	Research Methods
SPA 603	Advanced Audiology
SPA 613	Language Development for Children with Hearing Deficiencies
SPA 721	Seminar in Audiology - Diagnostic Procedures
SPA 723	Seminar in Audiology - Rehabilitative Procedures
SPA 701	Amplification: Assessment and Applications
SPA 703	Electrophysiologic Audiometry
SPA 705	Central Auditory Dysfunctioning, Testing, Remediation
SPA 710-1	Management of the Hearing Impaired
SPA 710-2	Evaluation and Referral of the Hearing Impaired
SPA 710-3	Service Delivery to Mainstream the Hearing Impaired
SPA 612	Disorders of Language
SPA 699 or 700	Directed Study/Thesis Research
SPA ___	6 semester hours in Speech Pathology - Voice, Articulation, Language
Electives	3 hour elective chosen with advisor: Assessment in Special Education
SPA ___	6 hours clinical practicum

Total = 44 semester hours

Diagnostic testing for site of lesion and central auditory disorders as required

Direct intervention, including hearing aid fitting, orientation training and counselling, aural (re)habilitation, hearing aid checks and maintenance, speech-language development training

Counselling services for the hearing impaired and their families.

2. As Case Management Specialists, the educational audiologists:

Have oversight responsibility over the case's hearing (re)habilitation program

Coordinate ancillary services to the hearing impaired

Develop and coordinate in-service training for public school and health personnel

Assure follow up and delivery of appropriate services

Serve as referral coordinators for supportive evaluations

Supervise performance evaluation of the hearing disordered

3. As a resource, the audiologists:

Provide direct support to service deliverers in the consultative model

Provide resources to other health care professionals in service delivery, counselling, and program planning

4. As advocates for the hearing disordered, they:

Enhance public awareness through public speaking and knowledge of interview techniques and strategy

Work to prevent hearing loss through creating wider awareness of genetic, environmental and other factors that result in hearing disorders

Provide environmental acoustic management to assure optimal conditions

Provide parent and group counselling

Represent the hearing impaired in IEP planning and conferencing

The Model Service Center. Phase II of the program is the establishment of a Model Service Center (MSC). Not only is the

center equipped to provide diagnostic and evaluative services but it serves as a focal point for the program and is the referral and management center of the hearing involved children.

In our program, we chose not to build a facility in the initial stages. Instead, we entered into an agreement with the DOE that allowed us to serve as the MSC. Existing staff and students in training provide the services both in our clinic and at school sites on a contractual basis. We provide the basic equipment and space at the university center and the DOE provides such intrumentation as is needed for testing, etc. in the schools. Program supervisors are on-site for all school delivered services. Although equipment and material costs will vary among districts, we project a total operating expense of approximately $48,000 for the year, including salaries and additional equipment but excluding space, utilities, etc. We will have the capacity to provide at least 200 full evaluations with a larger number of less involved evaluations, screenings, etc. plus in-service due to the force-multiplier effect of having graduate students in training provide services under supervision. This arrangement has added advantages to the State DOE. Initial equipmert costs were reduced to approximately $17,500 for three portable immittance bridges, two sound level meters, one portable hearing aid evaluation instrument and some lesser items (otoscopes, etc.). Supervisory staff were hired by the University with the understanding that we would maintain the center in the near future under contract with the DOE. Ultimately, the operation will pass to the DOE. At that point, there will be one center for each major island with audiologists assigned to each county (local education agency equivalent).

In rural and remote areas, the concept of permanent site is less appealing due to generally low utilization potential. Developing affordable, workable alternative delivery systems is the key ingredient to program success. Options include portable equipment, duplication, mobile centers (specially equipped vans), contracts with outside providers. The latter alternative is attractive to many communities because of the potential to attract private providers of health care in areas that otherwise could not. The model developed by the U.S. National Health Services Corps for developing health services in rural and underdeveloped areas might prove helpful (USPHS).

Service Delivery to the Schools, Phase III, services delivery is underway. We have a project service director who also is the educational audiologist for the training program and we have a supervisor of clinical services to direct the clinical services in the MSC.

Services to the schools include an information network, referral center for children with suspected hearing disorders, in-service, counselling, prescriptive diagnosis, specific counselling in areas such as training with children whose intellectual progress has been affected by sensory deprivation. Staff and supervised students provide demonstration of alternative teaching techniques, along with the other functions noted in Section 4. One

particularly useful service has been the acoustical analysis of school facilities. Acoustic measures and recommendations based on the results have proven to be most valuable in assisting school personnel to understand and compensate for poor acoustic environments.

Our program, now in its second year, is progressing well. Two audiologists have completed training, two more are almost finished. The MSC is operating, providing hearing evaluation, educational placement recommendations, hearing aid evaluations, and patient management. We have the staff in place and services are expanding.

Although services were begun in the schools in the spring of this year (1986), the formal start is Fall, 1986, when the first two graduates enter the schools. They will be joined in January, 1987 by two more audiologists. The basic service syllabus, described earlier, will be expanded across districts as personnel availability allow. Eventually, service centers will be in place on all islands with at least one audiologist in each district. We planned to have a state wide network in-place within six years from the start of this program.

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